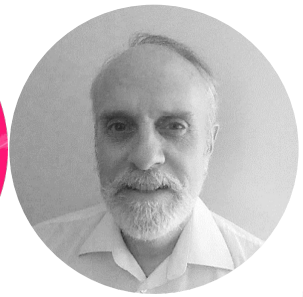
The Decorator Pattern



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Motivation

Car dealership

Three models:

- Economy
- Luxury
- Sport

Options:

- Engine size: 4 or 6 cylinders
- Paint color: white, red or black
- Upholstery: leather or vinyl

Cost depends on the model and options

Try a class-based approach

Demo

Start with an abstract car class

Define concrete class for each model

Subclass each model for option combinations

Using Subclasses

One subclass per model/options combo

Only two combinations

3 models, 2 engines, 3 colors, 2 upholstery types

3 x 2 x 3 x 2 = 36 subclasses!

What about the real world?

Thousands of combinations!

Subclass explosion

Maintenance nightmare

Demo

Start with an abstract car class

Define a concrete class for each model

Use properties for the options

Using Properties

One concrete class per model

More properties to implement

More complicated constructor

Maintenance?

What if the options' prices change?

- Open up ABC

Add interior color property?

- Open the ABC and concrete classes

Principles Violated

Single Responsibility

Open/Closed

Interface Segregation

Dependency Inversion

Don’t Repeat Yourself

Decorator

Classification: Structural

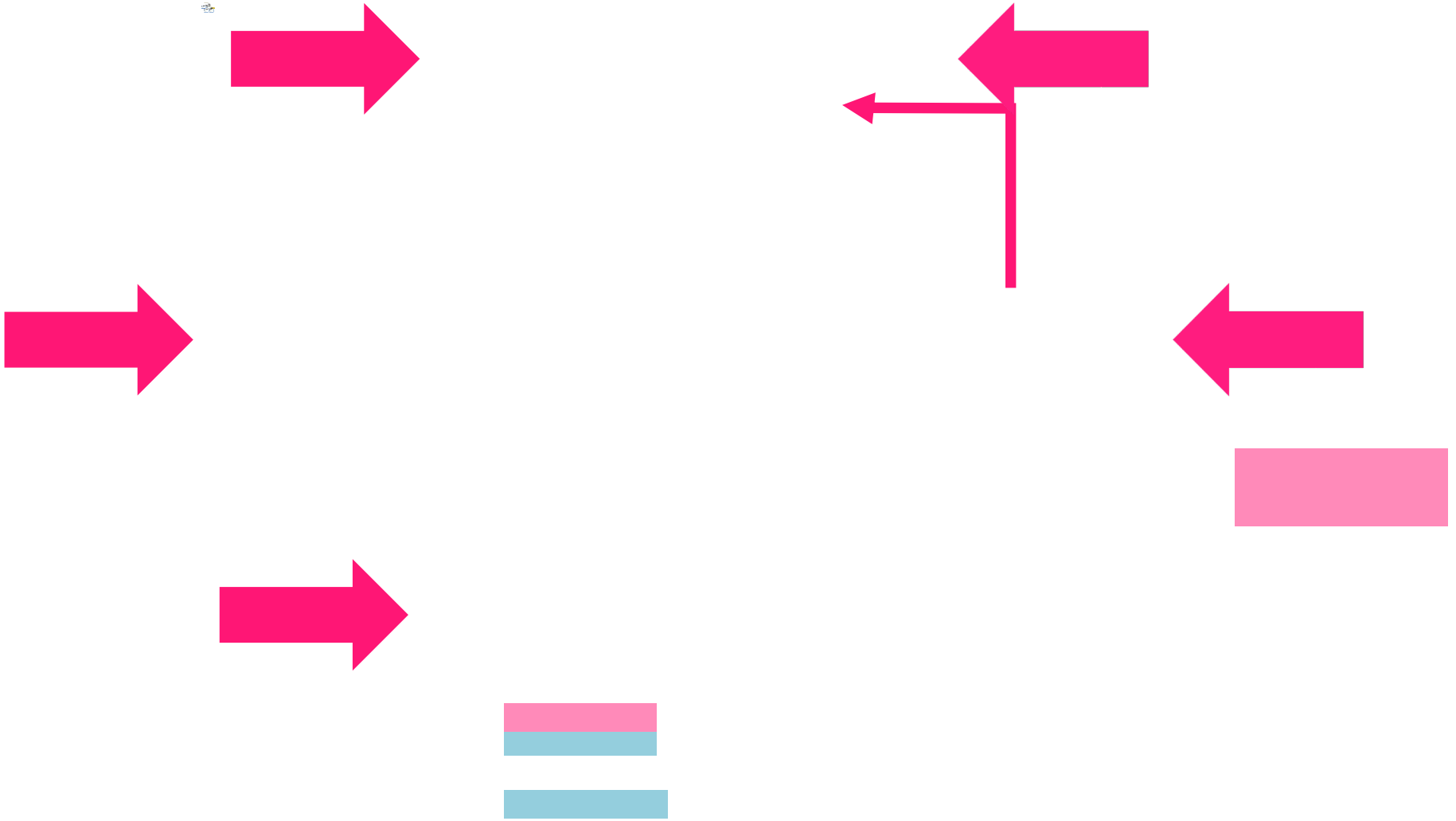
Adds new abilities to an object

Dynamically, at run time

Flexible alternative to subclassing

Also know as the Wrapper Pattern

Decorator Pattern Structure



Demo

Follow the Decorator Pattern structure

Use decoration instead of subclassing

Consequences

More flexible than static inheritance

Keeps things simple

No practical limit to decorations

Transparent to clients

A decorator has a different type

Many little objects

Factory and Builder patterns can help

Decorator Pattern vs. Python Decorators

Decorator Pattern	Python Decorators (@decorator)
Class definitions	Function definitions: @ syntax
Wrap class instances	Wrap definitions
Run time decoration	Compile time decoration
Add functionality to instances	Add to functions and classes
Specific purpose	General purpose
Gang of Four	PEP 318
	https://www.python.org/dev/peps

Summary

When to use Decorator?

Add new functionality to existing objects

Better than many subclasses

Better than many properties

Consider using Factory or Builder

Prototype